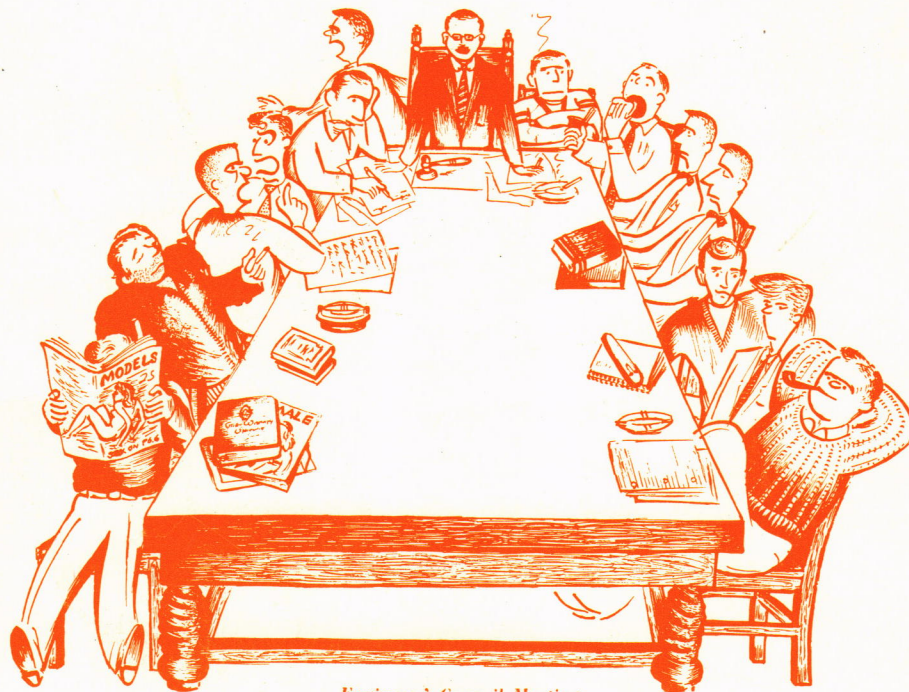


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• THE GEORGE WASHINGTON UNIVERSITY

• EDITION 1, FALL 1989

MECHANICAL CIVIL



Engineers' Council Meeting

PUBLISHED BY THE ENGINEERS' COUNCIL IN COOPERATION WITH THE ENGINEER ALUMNI ASSOCIATION

MECHELECIV

Established 1942

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WELCOME BACK TO SEAS 1989-90

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COVER

This comical cover is an editorial cartoon from the November 1953 issue of *MECHELECIV*. It depicts a typical meeting of the Engineers' Council in the 1950's.

MECHELECIV is a student and alumni magazine published 4 times a year (two times a semester) at the George Washington University by the direction of the Engineers' Council and in cooperation with the Engineer Alumni Association. MECHELECIV serves the Engineering School community as a responsible student/alumni magazine, independent of the School and University administration in its management and decision making. MECHELECIV is managed and administered in accordance with the "Policy and Procedures Governing the Cooperative Publication of MECHELECIV by Engineers' Council and Engineer Alumni Association." This document was agreed upon and signed on September 20, 1984 by the Engineers' Council and the Engineer Alumni Association. Subscription: \$10.00 per year. Circulation: 5,000-10,000. ISSN #: 0047-6387. Second class postage paid at Washington, D.C. Address all communications to: MECHELECIV, Davis-Hodgkins House, 2142 G Street, N.W., Washington, D.C. 20037 or call (202) 994-3998. The content of this magazine represents the individual expressions of the authors or editors and does not necessarily reflect the views or attitudes of the student body or the University administration.

Welcome to Mecheleciv

Welcome Back!

It promises to be an exciting year for *MECHELECIV*. Many changes have been implemented over the summer to give us a new look. One of our major improvements is the conversion from conventional cut and paste to desktop publishing. Desktop publishing provides us with the capability to make changes with the push of a key and the flexibility to take advantage of the latest in computer technology, such as scanned images. Therefore, one of our primary goals this year is to obtain our own computer. In essence, this conversion and other improvements enable us to bring you the best magazine possible.

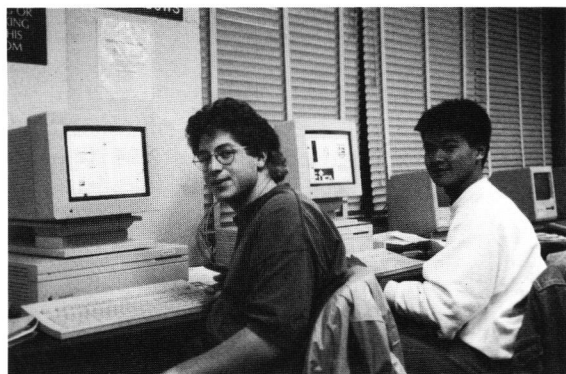
In keeping with the new Engineers' Council's theme of "**GETTING INVOLVED**," we have expanded our *Campus News* section to include reports from all the engineering societies and organizations. This section will appear in each issue to keep you informed about the activities going on around you. We feel that this will increase awareness and bring the GWU Engineering Community closer together. The rest is up to you.

This year we intend to work closely with the Engineering Alumni Association. The alumni have a wealth of knowledge and experience which would be invaluable to any engineering student. In subsequent issues, we plan to have articles contributed by, or written about our outstanding alumni. The past is where our future is.

We have many people to thank for helping us to bring this first issue to you. First and foremost, we would like to thank last year's editors: Lilimar Avelino, Rose Province, and Swati [Patel] Santosh Shah. Their outstanding work last year has provided us with the groundwork on which to build. Furthermore, their advice and support have been invaluable and inspirational. We wish them all the best. We would also like to thank the Engineer Alumni Association for the \$500 they so generously donated to our magazine last year. To all the engineering organizations for their letters and logos, we thank you. Finally, we would also like to thank and welcome the new *MECHELECIV* staff.

We hope that this theme of involvement will also result in greater participation in *MECHELECIV* by engineering undergraduates, graduates, alumni, and faculty. This is **your** magazine and it represents our school to over 5,000 readers. Therefore, we need your help. We are open to any suggestions or comments that you may have. Or better yet, you can make a difference by writing or editing articles, taking pictures, helping with layout, or getting advertising. If you are interested, please contact us, or visit our office at the Davis-Hodgkins House 994-3998.

Our staff is young and enthusiastic. We have many new ideas to share, and the desire to see them in print. Through *MECHELECIV*, we will keep you informed of everything from events on campus to breakthroughs in technology. We look forward to a great year together. Remember, there is always a place for you on the staff of *MECHELECIV*.



Glen Popick (left) and Nelson Kee, publishing issue one.

Sincerely yours,

Nelson M. Kee, Editor in Chief

Glen L. Popick, Co-Editor

Welcome to GW



Harold Liebowitz, Dean SEAS

MESSAGE FROM THE DEAN

It is a pleasure each year at this time to speak from the pages of *MECHELECIV* to the newest members of the SEAS community, the entering freshmen; to our returning students; and to our alumni here and abroad. Increasingly we appreciate, from each of these vantage points, that life in the study and practice of engineering makes for a lifetime of learning and discovery.

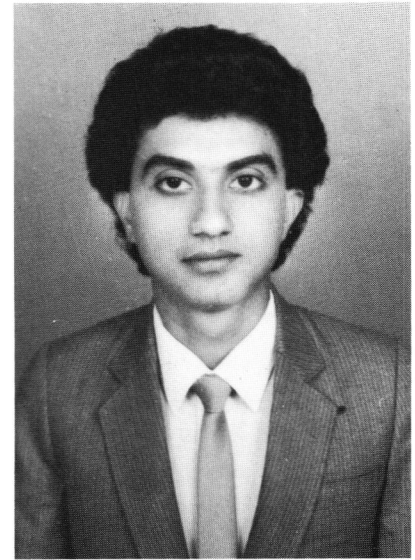
As the new academic year gets underway, a summer of preparation by members of the faculty and staff has culminated with the process by which professional review and evaluation bodies periodically renew the school's accreditation — its license to practice in areas of instruction. Former U.S. education secretary William J. Bennett said a few years ago of this process of "credentialism" that it "must begin to reflect our demand for excellence, not our appreciation of parchment." This notion is reflected on campus in vigorous ongoing efforts to keep current our curriculum and resources; and mirrors concerns among employers for the qualitative ability of our engineering schools to prepare students to tackle the challenges posed by new technology.

Recent trends and accomplishments at the School of Engineering and Applied Science, beginning with the high standing of our students among their University peers, demonstrate our commitment to meeting this imperative. Last year again marked a successive annual climb in the impressive academic standing of our entering freshman class — the highest University-wide, based on class rank and mean SAT test scores. We have enhanced our strong teaching and research faculty through new hires, development, and recognition — also recently evident in top professional recognition to a number of faculty members in their respective fields. We have expanded our ambitious research program, not only in client base and revenues (over \$9.5 million in 1988-1989), but in capabilities as well — capped with the competitive selection of the School for receipt of a \$1.5 million gift to the in-house SEAS Computing Facility from Hewlett-Packard, Inc.

Finally, we have accelerated our active presence in the community through exciting outreach activities, such as the successful Science and Engineering Apprentice Program [SEAP] for outstanding secondary school students; and by planning for the coming expansion of programs and offerings to the University's Northern Virginia campus, under development. Participation last year by over 15,000 practicing engineers worldwide in the Continuing Engineering Education Program and the establishment of agreements for exchange and cooperation with leading colleges and universities overseas further helped to establish our global role.

From the studious energy and high standing of our newest students, to the industriousness and career achievements of our graduates, our success as an institution and as a community accrues from the collective aspirations and accomplishments of each of you — and the demand for excellence in each of your lives.

Harold Liebowitz
Dean, SEAS



Javid Sonde, President Engineers' Council

Welcome!

It is a great honor to be chosen to welcome the students of the 1989 - 90 academic year. I must assure you that The George Washington University promises a well balanced educational curriculum and I urge you to take advantage of it.

In an attempt to promote the best possible learning environment, the Engineers' Council voices the opinions of the students on critical issues affecting the students and the University. Strong participation and interest in the previous year contributed to an election that stands out among others of recent years in terms of competition and involvement. This past election did show a dramatic change in trend—a definite sense of ownership. To those who were not elected, I would like to encourage you, nonetheless, **to get involved**. Your ideas and suggestions are of vital importance to the school and your fellow students.

We appear to be headed for a successful year ahead with continuing support from the Dean's office, the alumni, and numerous other faculty members from all departments. Our effort will be to work together with the administration and help students in their social and academic endeavors. While much

Welcome to GW

emphasis is placed on academic pursuits and excellent test scores, I would also encourage you to **get involved** with student life and build yourself a fortress of other qualities which greatly increases your scholastic skills.

Much of my present effort has been to reach out and communicate to students of the engineering community, and also to bring the School of Engineering and Applied Science into the main-stream of the student life on campus. The recent Council would lend its support to issues of concern to minority engineers, namely women, blacks, and American Indians, who would like to contribute to the activities of the engineering school and the GW community at large.

A word of thanks to the outgoing staff of the *MECH-ELECT*, who worked hard to keep the magazine going. Passed on to safe hands, we now look forward to a high quality Engineer's magazine of which we all can be proud.

Finally, the key to success in all work is "team effort." Much can be attained when goals are common and efforts unified. Let us get together under our professional brotherhood of "engineering" and remind ourselves that, "It is for others to dream, but it takes an engineer to put their dreams together."

Javid Sonde
President
Engineers' Council 1989-90

Engineering Alumni Schedule of Events

November 3, 1989: Engineering Administration Alumni Dinner

February 1-3, 1990: Homecoming Basketball Game.

February 18, 1990: Engineer's and Architects' Day luncheon.

March 1990: G.W.U. Phonathon

April 1990: Dean's Reception

April 6-7 1990: Reunion Weekend



Nahid Khozeimeh, President EAA

Dear Engineering Alumni,

It is my pleasure to write to you again from the campus of your alma mater. As the days began to grow shorter with the approach of fall, classrooms and laboratories were being readied for new and returning students arriving in September, while participants in the school's various summer programs completed their work. Desks and drafting tables just vacated by recent graduates gone to the workplace, are now the workbenches for the next generation of apprentices in our craft.

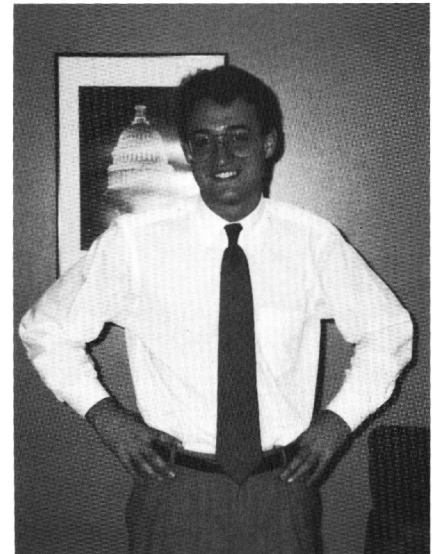
To the graduates of the Class of 1989 in the Washington area and their fellow alumni of preceding years, I am happy to extend to all of you an invitation to become involved in the Engineering Alumni Association and the Engineers' Council. Additional information on the upcoming events can be obtained by contacting the EAA office.

Lastly, I would like to encourage you to participate in the Distinguished Frank Howard Lecture Series, sponsored annually by the EAA in an ongoing effort to recog-

nize and bring to the University outstanding thinkers in the engineering sciences. Information on this program also can be obtained by contacting the offices of your alumni association.

Best wishes to all of you.

Nahid Khozeimeh
President Alumni Association



John David Morris, President GWUSA

BUILDING BRIDGES

This year's GW Student Association is reaching out to the students of the Engineering School, among the most academically distinguished of GW's divisions. You want more of a campus experience during your time at GW, and we at the Student Association are working to bring it to you.

The GW Student Association is the University organization chartered to represent GW's students. Together with my staff, I maintain contact with most GW administrators and represent our concerns and ideas to them. Through our office, all

(continued on next page)

Campus News!

continued from preceding page

students are given a voice in the decisions that affect our life here.

We also provide you with valuable services like the Test File, the Campus Escort Service, and the Student Advocate Service. In addition, we have organized some exciting events for the coming year:

Opening Convocation - the ushering in of the new academic year, with pomp and circumstance aplenty. Scheduled on September 8, it was the University's biggest ceremony yet.

Homecoming - in early February, you can look forward to a GW homecoming we will all be proud of, with students, faculty, administrators and lots of alumni, joined together in common endeavor: *GW spirit*.

Washington Discovery - an ongoing program which enables students and professors to develop ties while gaining a greater understanding of the city which surrounds us.

My office is always open to you if you have a problem or suggestion which you would like to discuss. As engineering students, you undergo an especially rigorous academic program. But, that doesn't mean you can't be involved in our growing campus life.

I think GW is the greatest school around and I also believe that it just keeps getting better and better. Let's make the coming year the best ever.

John David Morris
President, GW Student Association



TAU BETA PI

Tau Beta Pi is the national honor society for engineering. Its purposes are to recognize outstanding students and professionals from all engineering disciplines, and to foster a spirit of liberal culture in engineering colleges by encouraging students to pursue a variety of non-professional interests.

During the upcoming fall semester, Tau Beta Pi members will hold regularly scheduled tutoring sessions for many first and second year core curriculum classes. Tutoring is free and open to all School of Engineering students. Details and a schedule will be distributed as soon as they are available.

This semester, for the first time, Tau Beta Pi is attempting to organize a textbook rental service. If you have old textbooks that are just gathering dust, or if you want to rent someone else's, feel free to contact Paul Keiser (994-9521) or Sanjeev Gulati (323-6327).

Juniors who place in the top one eighth of their class and seniors in the top fifth of their class will be notified of their eligibility for membership in Tau Beta Pi some time in the next two weeks. We hope all those eligible will pursue membership in our society, and we look forward to serving the School of Engineering, the University, and the community in the coming school year.

Paul Keiser
President, Tau Beta Pi

ASME

The American Society of Mechanical Engineers is a national, non-profit, technical organization that deals with increasing world technology. The ASME serves both the needs of industry and the government. There are 32 technical divisions ranging

from materials and structures to systems and design.

On the student level, ASME has much to offer. The following is an outline of the student section's objectives.

(1) provide students with an opportunity to begin professional careers by joining a professional engineering society

(2) inform students of recent developments in the field of mechanical engineering through field trips, meetings, and publications

(3) promote fellowship and interaction with other student sections as well as professional sectors of the society

(4) get students involved in mechanical engineering related projects and activities on campus

Among the activities that the GW student section gets involved in are the egg drop contest and the Engineers' Olympics. We are planning field trips to Goddard Space Center and some manufacturing plants in Baltimore. The biggest ongoing project that we are currently dabbling in is the Mini-Baja vehicle which is covered elsewhere in this issue. We also have a voting representative in the Engineers' Council which is the governmental organization for the School of Engineering.

Membership in our organization is open to all engineers regardless of discipline and I would encourage anybody who displays an interest to attend our meetings and sign up for the membership. Annual student dues are only \$7.50 and along with the above benefits you will receive the monthly Mechanical Engineering magazine and come graduation time, involvement in ASME looks great on your resume. You can contact the student section president, "Ski" Pragnesh Shah, at 333-6327, for any further inquiries.

Greg Friend
Mini-Baja Chairman

SEAS Students Getting Involved

Theta Tau Something More

Theta Tau is the oldest and largest professional fraternity in the country. The fraternity was founded in 1904 at the University of Minnesota. We have 22 chapters throughout the nation, and our total number of initiates has surpassed 25,000. Theta Tau is the fraternity for engineers.

Theta Tau offers more than just a club to belong to for a couple of years while in college. Theta Tau blends the best features of social fraternities and technical societies together to prepare our members for their professions in engineering. Members of Theta Tau are brothers, united by a common interest: the pursuit of engineering. The purpose of the fraternity is to form the friendships that will last long after college is over. Membership in Theta Tau is for life, not just for a few semesters. Our common interest in engineering, in all its forms, provides a strong foundation upon which these friendships can be built. Theta Tau will seek to develop not only your academic skills, but also your character and leadership skills. There should be more to your college experience than just classes.

We meet the professional and the social needs of our members. Our professional program generally includes speakers, workshops, an interaction with our alumni and faculty. We are not limited to the concerns of one discipline, our members are from all branches of engineering. Socially, we throw parties, have picnics, take trips to other chapters, and form intramural sports teams. But it is our fraternal bond, its teachings and practices, and the formation of lasting friendships that will truly be of value.

Look for our activities or call the me at 994-9745 and find out what else the college experience can do for you.

Chris Goldsmith
Theta Tau Rush Chairman

The Return of Theta Tau

September 23, 1989 marked the return of the Gamma Beta Chapter of the Theta Tau Fraternity to The George Washington University. Theta Tau, for those who may not know, is G.W.'s only professional engineering fraternity. It is not an honor society, nor is it solely a social fraternity. The purpose of Theta Tau, "is to develop and maintain a high standard of professional interest among it's members and to unite them in a strong bond of fraternal fellowship." Thus, Theta Tau serves two purposes: professional development and fraternal bonding.

The curious reader may then ask, from where is Theta Tau returning? The answer to this question requires a brief delve into the history of the Gamma Beta chapter of Theta Tau. Gamma Beta was started by fourteen G.W. engi-

neering students on September 28, 1927 as Phi Theta Xi. After resolving all the organizational issues involved, Phi Theta Xi, wishing to to secure a strong future for their fraternity, petitioned Theta Tau for Chapterhood. The installation of the Gamma Beta chapter of Theta Tau at George Washington University occurred on March 16, 1935. One of the earlier chapters of Theta Tau, it enjoyed a long and colorful history. That is, until 1976, when the university determined that it must admit women. This created problems between the Gamma Beta Chapter and the National Headquarters because the National Constitution restricted membership to males only. The conflict could not be resolved and Gamma Beta Chapter became inactive in October, 1976.

This return of Gamma Beta, however, was not an easy task. Recognition must go to Dr. Douglas Jones, Lt. Commander Sean Walsh, and the Charter members of Gamma Beta, for the diligence and hard work that brought Gamma Beta back.

James Nix
Corresponding Secretary
Theta Tau



Brothers of ΘT , at the Reinstallment of the Gamma Beta Chapter

Campus News!



Eta Kappa Nu is an international society honoring outstanding upperclass electrical engineering and computer science students. The Theta Iota Chapter here at the George Washington University is very active in the School of Engineering and Applied Science.

Near the end of each fall and spring semester HKN conducts a survey of all EE/CS courses. The surveys ask students to evaluate their professors on several topics. The results are printed in a brochure that is provided for students at the EE/CS department in the Academic Center during the next registration period in order to help them in picking the courses they want to take.

The results of the surveys are also used as part of the process for presenting Teacher of the Year awards to one full-time, one part-time, and one graduate teaching assistant each year. This is a prestigious award recognizing the best of the EE/CS faculty.

HKN also participates in several other activities at GW. HKN organizes the EE/CS portion of the Engineers' Week competition. HKN presents the Abdelfattah Abdulla Award each year which recognizes and honors the EE/CS junior or senior who has shown outstanding academic achievement and has made the most significant contributions to the EE/CS Department, IEEE, and HKN.

EE/CS juniors, seniors, and graduate students who are in the top portions of their class rankings, and all instructors are eligible for membership in HKN.

Jason Fey

President, Eta Kappa Nu

Black Engineers' Society

The Black Engineers' Society (BES) of The George Washington University was founded in the Fall of 1971, to function as a support group for minority engineering students and to help resolve most of the common problems experienced by these students.

Today, the BES is a chartered chapter of the National Society of Black Engineers (NSBE), a non-profit organization dedicated to the recruitment, retention, academic progression, and successful graduation of minorities in engineering. There are currently over 120 chapters nation-wide encompassing over 5000 members.

In collaboration with the NSBE, the Black Engineers' Society of GWU participates in engineering job fairs, regional and national conferences at various universities on the east coast, and around the nation. We have performed numerous community and campus activities including technical presentations and seminars, group study sessions, and tutoring sessions. This year, the BES plans to initiate programs aimed at stimulating minority youths at the Junior and Senior High School levels in the Washington, D.C., area to consider engineering as a career path.

For more information please call me or visit our office.

Samuel Ben
President NSBE
Building HH
2127 G Street NW
Washington, DC 20052
994-1467



National Society of Professional Engineers

The National Society of Professional Engineers (NSPE) was founded to promote Professional Engineering (PE) registration. Registration, or licensing, is usually achieved by both passing the PE examination and acquiring Engineering experience. Prior to attempting the PE exam, the Engineering in Training (EIT) or Fundamentals of Engineering (FE) exam must be surmounted. The EIT is generally perceived as the more difficult of the two exams since it encompasses a very wide spectrum of engineering disciplines, presenting questions in the areas of EE, ME, CE, OR, English, economics, computer science, physics, chemistry, and mathematics.

The GWU student chapter of NSPE was established to help ease the passage of the EIT. Since our charter in the fall of 1989, our main goal was to create free prepratory classes for the EIT. Such a course was piloted last spring by the Department of Continuing Engineering Education, and will be offered annually in preparation for the April administration of the EIT.

Over 30 GWU students and alumnae were registered to take the EIT in April of 1989, with most of these individuals enrolled in the course. The vast majority of those enrolled passed the exam.

Membership in NSPE is open to all disciplines of engineering. If you are interested in joining, or if you have any questions about NSPE, please call either Richard Biby at 534-0034 or David Schnaper at 528-8489.

Rich Biby
NSPE Representative

Korean Engineering Student Association: A New Presence at G.W.

The new semester brings about the formation of a new engineering organization on the G.W. campus: The Korean Engineering Student Association (KESA).

SEAS Students Getting Involved

It was formed during the last months of the spring semester in 1989, when it established its officers, members and the groundwork for its upcoming activities.

When talking with Dong Min Joo, a graduate student majoring in electrical engineering (communications) and the president of KESA, he spoke of these goals for the organization:

"We wanted to have an organization where Korean students interested in engineering could gather and stimulate ideas and conversation. Also we wanted to make GW engineering students more aware of what is going in Korea with it's emerging industry and technology. We plan to have lectures and discussions with guest speak-

ers and professors from Korea so that students can ask questions and develop an understanding of new developments there.

We also wanted to increase our participation in the GW community by working with the Engineers' Council and the other organizations here on campus. With an initial membership of 30, consisting of under-grads to post-graduates, we have just started, but I am sure that the GW community will feel our presence and commitment throughout the school year."

Anyone interested in KESA can contact Dong Min at 691-0769.

Chong Bum Lim
Vice-President, KESA

ASCE STUDENT CHAPTER

If you have chosen civil engineering to be your profession, you should be interested and concerned with all the facets of civil engineering. Therefore, you should take advantage of the opportunity to join the GWU-student chapter of the American Society of Civil Engineers (ASCE). This will help you to advance toward your chosen profession and the exciting career opportunities that lie ahead. The American Society of Civil Engineers is the oldest national engineering society in the United States. Founded in 1852, ASCE has more than 105,000 members, including over 12,000 National Student Members.

The benefits of National Membership include:

(1) "Job Search Handbook of the Graduating Civil Engineer," a package of guidelines, with information on job-searching, resumes, interviewing and compensation. (2) Recognition by prospective employers of ASCE membership. (3) Scholarships/Fellowships/Awards/Grants

(4). Information on EIT/PE review courses. (5.) Civil Engineering Magazine (monthly) and ASCE News (monthly newspaper). (6) Salary information on entry level and experienced engineering jobs. (7) Opportunity to network nationally with 12,000 other civil engineering students. (8) Professional recognition through advancement to Associate Member, Member and Fellow Grades. (9) Use of Engineering Societies Library, the world's second largest engineering library which encompasses more than 275,000 volumes: 5,000 periodicals and 240,000 published and unpublished papers. Loans are available by mail or phone. (10) Reduced rates for ASCE journals and manuals.

The Benefits of Local Membership include:

(1) Attend lectures by top civil engineering professionals to discuss the latest civil engineering developments and technological innovations. (2) Network with practicing civil engineers.

To join up, please contact Prof. S. Sarkani in Academic Center Rm. T716, 994-5966. He will be extremely eager to help you.

**AMERICAN
SOCIETY OF
CIVIL
ENGINEERS
FOUNDED
1852**

SOCIETY OF WOMEN ENGINEERS

The Society of Women Engineers is a non-profit, educational, service organization. Its particular business and objective shall be exclusively educational and in the furtherance of such educational purpose to inform the public of the qualifications, abilities and achievements of women engineers. SWE brings about a better utilization of engineering talent for the economic and social benefit

of humanity and encourages young women with suitable aptitudes and interest to enter the engineering profession and SWE provides them with guidance in their educational programs. To be more specific our goals are to:

(1) inform young women, their parents, counselors, and the general public of the qualifications and achievements of women engineers and of the opportunities open to them.

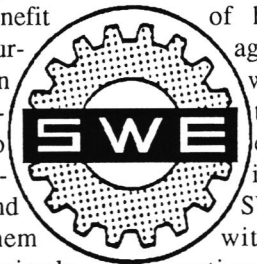
(2) to assist women engineers in readying themselves for a return to active work after temporary retirement.

(3) to serve as a center of information on women in engineering.

(4) to encourage women engineers to attain higher levels of educational and professional achievements.

Furthermore as part of its national educational activities, SWE administers approximately 38 scholarships annually varying in amount from \$1,200 to \$2,500 and totaling more than \$210,000. SWE organizes a number of activities ranging from dress for success fashion shows to the teaching of resume development. It also addresses such important topics as sexual harassment and discrimination in the office. For more information, please contact Professor Dianne Martin or Professor Heller.

Rama A. Chakaki
President, SWE



Campus News!

Omega Rho [ΩΡ] The International Honor Society



Omega Rho is a society of collegiate chapters and members, founded in 1976 to honor excellence in operations research and management science related disciplines. Its purpose is to recognize superior scholarship and encourage leadership in these disci-

plines. The society has 32 chapters and more than 2500 student and faculty members. It is a member of the Association of College Honor Societies.

The GWU Chapter was founded in 1976, and has maintained uninterrupted activity since its founding. A small sample of past achievements include: 1) Winner of the "Outstanding Chapter Award" for the academic year 1987-1988. 2) Praised by the University's Career Development Center for outstanding participation during "Career Week." Career support development with the "Career Listing Notebook." 3) Yearly co-sponsor of the Annual OR picnic, with the GWU Engineer Council, and the GWU Engineer Alumni Association.

Admission to the society is due by invitation, based on outstanding academic performance. The GWU chapter has 230

students and 19 faculty members to date.

Omega Rho specializes in career and professional development. It played an integral role in "Career Week" during February 1989, by organizing a panel under the title: "Careers in Operations Research. Hints from the Experts." The chapter also co-sponsors lectures on several topics of interest, the latest being: "Designing the Aviation System for the 21st Century," by Robert E. Machol, Chief Scientist of the Federal Aviation Administration. Socially, Omega Rho helps to sponsor the Joint Honor Societies Banquet, with the other SEAS honor societies, and aids in the annual SEAS picnic.

How're you going to do it?



WHO CAN BUY?

All full & part-time students, faculty and staff of The George Washington University & Medical Center. Departments and offices may also purchase PS/2's under this special offer.

*This offer is limited to qualified students, faculty and staff who order an IBM PS/2 Model 8525-001, 8530-E21, 8550-031, 8555-061 or 8570-E61 on or before October 31, 1989. Orders are subject to availability. IBM may withdraw the promotion at any time without written notice.

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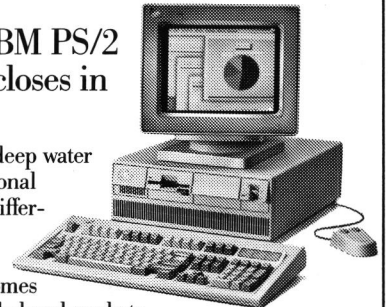
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Before you find yourself in deep water this semester, get an IBM Personal System/2.[®] Choose from five different packages of hardware and software—all at special low student prices. Each system comes with easy-to-use software loaded and ready to go! What's more, when you buy your PS/2,[®] you can get PRODIGY,[®] the shopping information and entertainment computer service, at less than half the retail price. And for a limited time, you can get special savings on your choice of three IBM Proprinter[™] models.* Don't miss the boat. Come in today.

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The 1989 Mini-Baja East

This past May, our school again entered an all-terrain vehicle in the Mini-Baja competition, after a four year hiatus. Just after final exams, four students and a small group of faculty and staff members packed their bags and headed for the hills of Morgantown, West Virginia for an unforgettable three days of hard work, fun, and excitement. This year's hosting school was West Virginia University. The 1990 competition will be held in Orlando, Florida.

The Mini-Baja East, is an annual event that is sponsored by the Society of Automotive Engineers (SAE). The objective of the competition is for a group of undergraduate students to design, build, and operate an all terrain vehicle that conforms to all the race specifications.

The competition is comprised of 12 separate categories. In the first three, each vehicle is rated for its safety features, cost, and overall design. After each vehicle passes the mandatory inspection process, it is set into motion and competes in the acceleration, top speed, and braking contest. Following these it's on to the power pull, land maneuverability, stability run, water maneuverability, hill climb and the dreaded endurance race.

If for some reason, this all sounds like

fun... well, that's because it is. This year's GWU race team included me as Team Captain, Hilary Lewis as Coordinator, and Dave Herbert and Steve Damsky as dedicated volunteers. Our car did fairly well considering the short time given to design and build it from scratch, and the caliber of the competition which we faced.

Initially, 44 schools signed up for the competition, but on race day only 30 schools made it (an accomplishment in itself). One by one we trudged through each event with only minor problems plaguing us along the way such as the brakes fading in and out and throttle cable woes. Ultimately, we made it to the endurance race, which was a feat in itself. Seven schools' vehicles had become so beat from all the pounding incurred by the prior events that they were not able to

...it suddenly took on a large amount of water and did a nose dive for the lakebed below.

start the endurance race.

Dave Herbert decided he would take

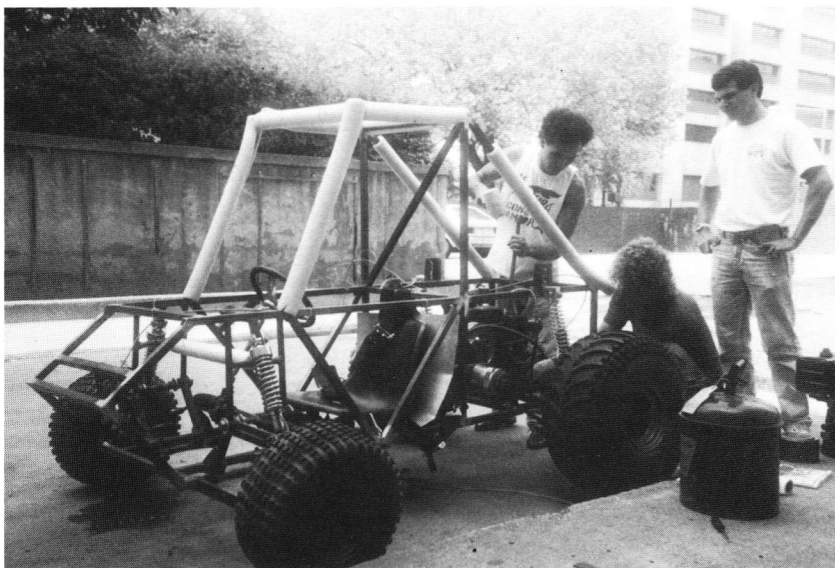


The Mini-Baja In Action

the wheel for the day. On our second lap, as Dave piloted the car through the lake portion of the track, it suddenly took on a large amount of water and did a nose dive for the lakebed below. Luckily, Dave escaped to see another day and the car was exhumed from its watery grave by the divers so we won't have to start from scratch again next year.

After it was all over, the points were tallied and Tennessee Technological University came out on top. GWU wound up finishing 22nd overall, coming ahead of such schools as West Point, Drexel University, and Carnegie Mellon University. That's not a bad position to be in as a starting point for future Mini-Baja competitions. I would like to thank all my fellow students who helped out and the faculty and staff members who showed their support by attending this year's event. Alex Giraud also deserves special thanks for his help in the Tompkins Hall machine shop.

Our Mini-Baja program is funded by the Engineers' Council and organized through our student section of the American Society of Mechanical Engineers. I would like to extend an open invitation to any interested undergraduate engineering students and encourage their participation in this project. This project has much to offer, including real world knowledge of teamwork, design, manufacturing processes, and material science. For this, freshman and sophomores have the most to gain by becoming involved. Interested persons may either contact me, Greg Friend, at 625-6127 or speak to Dr. Kaufman.



Greg Friend, Head Mechanic, and Crew, Applying Final Touches to the Mini-Baja

Dean Liebowitz Speaks Out

Glen Popick

Harold Liebowitz, Dean of SEAS for the past 21 years, always has an open ear for students comments and questions. In this informal discussion he spreads some light on topics of interest to all engineers at GWU.

Mecheleciv: What were your goals when you first came to GW?

Dean: When I first came 21 years ago, I felt that the School of Engineering and Applied Science could be a much better school than it was at that time. If given the proper nourishment, [faculty and administration] it could become the Cal-Tech of the east.

Mecheleciv: How do you feel about

The most important consideration is that we have very high quality students.

GW now?

Dean: Since that time, I have changed alot. I don't see it as a small school anymore. We have 3500-3600 students, and I do see our undergraduate school being built up again to have 1000 students. . . . It is a very high quality undergraduate and graduate school. One can see an education [at GW] which is comparable to anywhere.

Mecheleciv: What are your impressions of the new students?

Dean: The most important consideration is that we have very high quality students. Our average scores this year have been 1210 on SAT scores. We will continue to look for very high quality students and [ones of] even higher quality.

Mecheleciv: You mentioned the quality of students is up, what about the number of students?

Dean: [The current] figures show a reversal in the undergraduate enrollment figures. We have more undergraduate, new students than we had last year.

Mecheleciv: What is being done to increase recruitment?

Dean: As you know, admission responsibilities are centralized, more so [than before] and we look to the new administration to handle the admissions for the School on the undergraduate level. That doesn't mean that we won't be cooperating in the admissions process. We have a whole list of what it is that we can do to have an admission enhancement program. This will insure that we are able to obtain the best students. Once you obtain them you also should be able to retain them. That means having a good orientation program, and also continuing our free tutorial program that the school sponsors [through Tau Beta Pi].

Mecheleciv: Could you describe a new program?

Dean: We have a Summer Engineering Apprenticeship Program (SEAP) that is supported by the Department of Defense. It is about one million dollars a year. We seek out high qualified high-school students, and provide [them] appointments in the government laboratories. Then we give them two courses on Saturdays, for which they receive college credit. Again, we are pulling from a pool of brighter students. Especially at a time like this when the demographics are showing that there are fewer students that are available to enter college, we are doing many things to offset that.

Mecheleciv: How is the new administration helping out?

Dean: With the new administration, we are reviewing everything. For example they have helping in the NROTC. They, Vice-President Turner and President Trautenberg, for example have given financial aid for the NROTC students to get their

room and board free [to compliment there tuition scholarship.] I take my hat off to this administration for turning things around.

Mecheleciv: Could you tell us something about the facility being constructed in Northern Virginia?

Dean: It was supposed to be a graduate research and education center solely for engineering. [However,] the past president made it clear that to receive his cooperation it should be for the entire University. Since I was instrumental in acquiring the land and originating the concept, I felt that it could be good for everyone. The idea is, that every great institution is recognized by its graduate research. That spills over to the

There is two billion dollars in equipment that engineering schools are lacking throughout the nation.

undergraduates.

Mecheleciv: When will it open, and how large will it be?

Dean: It will open two years from this fall. The initial plans are for a building of 75,000 square feet. There are 576 acres of land, and there are about another 50-75 acres which are under option for the University to exercise below market price. It is a great opportunity for GW to increase its effort in the graduate school.

Mecheleciv: Would it shift the focus of graduate school out of the city?

Dean: I don't see it shifting the focus in the near or medium range. There will be a demand for the engineering school downtown. [Virginia] will supplement and enhance what we have here. What ever you do off campus, should be integrated with what you have on campus. It should enhance the education given by SEAS. It

Find Out Where SEAS is going - New Students, New Facilities, and the New Administration

should be one integrated unit. If you do that right GWU will be untouchable.

Mecheleciv: Moving on, how would you rate the lab equipment we currently possess?

Dean: If the purpose of equipment in an engineering school is to show what you learn in theory, to be able to compare results, and to prove an example, then we certainly are very good. We do not have large laboratories as in a state school. The computing center, however, is as fine a computer center as you will find in any academic institution. I would say we have an adequate amount to demonstrate scientific and engineering principles, to do more than that, for fine experimentation, for outstanding research there are some areas that we could enhance with further funding and space.

Mecheleciv: Is that where the Virginia facility comes in to play?

Dean: At the graduate level. I am not happy with some things which we have, but we are progressing in those areas. For example robotics and manufacturing, we should have much more equipment in these fields. We should have more equipment in the communications area, some updates. We have been getting some grants to help us in that. There is two billion dollars in equipment that engineering schools are lacking to date throughout the nation. Two billion dollars.

Mecheleciv: How do you feel about student involvement on campus, namely in the engineering student groups?

Dean: I think that in the past two years it [involvement] has been at a high. The organizations we have now, I am very proud of. I think it is part of your education to be involved. It prepares you for life much better. I know it's very good for me, because I would not have the kind of student inputs. It is your institution as well as mine.

Mecheleciv: As a brother, how do

feel about the recent reestablishment of Theta Tau?

Dean: I am disappointed that I [couldn't] attend the chapterhood ceremonies.

Mecheleciv: How do you evaluate the quality of education that you mentioned above?

Dean: I do read the evaluation when they are given to me. I get feedback from students, and annual reports on the faculty. To sit in on classes is a big brother sort of thing. It doesn't lend itself here. I value student evaluations: in the department, Tau Beta Pi, and the University academic evaluations. I do take these evaluations very seriously.

In summary, Dean Liebowitz feels that the School of Engineering and Applied Science is on an upward spiral. With increasing numbers of highly qualified freshmen entering the school, the quality of education also increases. With the recent upgrades in the computer center, the ongoing updates in the laboratories, and the new research center in Virginia, Dean Liebowitz feels that GW is truly on its way to becoming the 'Cal-Tech' of the east.

A Truly Inspirational Event

In April of 1989, Mona Zaghoul became the first woman to be promoted to the rank of full engineering professor at the George Washington University. This noteworthy accomplishment came after ten years of pioneering work at the University.

Her work has focussed on the establishment of a VLSI (Very Large Scale Integration) program and pioneering work in neural networks. She feels that the establishment of the VLSI lab at Tompkins Hall



Mona Zaghoul, first female full professor at SEAS

is of major importance due to the increasing dependence of industry on such circuits. The National Science Foundation currently funds her work with neural networks. Zaghoul notes, "neural networks is a new trend of computation based on building computers mimicking the human brain. Often, software is not enough to simulate huge problems. The trend is to go to hardware, using chips based on the neurology of a human."

Although she does admit that being a woman made it harder for her to obtain full professorship, she feels that the University has been very supportive. "In general, it is difficult for a woman to be an engineer. I hope my accomplishment will encourage women to look seriously at engineering as a career choice."

Mona Zaghoul received her Ph.D. in 1975 from the University of Waterloo, Canada. She became an Assistant Professor at GWU in 1979 and an Associate Professor in 1983. Professor Zaghoul has written over 50 papers and is currently participating in the Honors Research Program.

On behalf of *MECHELECIV*, I would like to congratulate Professor Zaghoul on her outstanding accomplishment.

Staff Writer

The B-2 Stealth Bomber

A Candid Interview With Dr. Joseph Foa



Joseph Foa, GWU Professor Emeritus of Engineering and Applied Science

After a decade of secrecy, the Air Force's B-2 "Stealth" bomber is embroiled in a controversy, which brings this \$72 billion, 132 plane project very much into the public's eye. The debate surrounding the flying wing is primarily focused on its high cost and questionable mission. However, the debate has hit very close to home due to a memorandum recently circulated to scientific organizations and members of Congress. This statement by Joseph V. Foa, a George Washington University emeritus professor of engineering, alleges a coverup of the flying wing's inferior range by Northrop Corporation.

The Stealth Bomber Concept

The concept of a stealth bomber was enthusiastically received by the Air Force. Not only was the bomber envisioned to have the capability to evade radar, by scattering and absorbing the electromagnetic energy, but it would also minimize the infrared, acoustic, and smoke and contrail signatures. The B-2's mission entails flying 6,000 miles unrefueled, eluding enemy radar, and dropping 25 tons of nuclear or conventional payload on targets, including mobile intercontinental ballistic missiles (ICBM), underground command-and-control centers, and ICBM silos. In 1981, Northrop won the

B-2 bomber program by resurrecting the 40-year-old dream of the company founder, Jack Northrop, of an all-wing aircraft. Since then, secrecy and speculation have surrounded the bomber.

Critics feel that the \$570 million cost per plane is prohibitively high for a mission which could be achieved by "stealth" cruise missiles. One critic said, "What we have is a plane in search of \$70 billion worth of mission." However, the Air Force and Northrop argue that much of the cost has already been spent on research and development, and production and tooling. Therefore, the flyaway cost is \$265 million. Furthermore, the B-2 would render the Soviet air defenses obsolete and would require them to spend several hundred billion dollars to counter the B-2 — which is much higher than the B-2 program cost.

The Controversy Begins to Unfold.

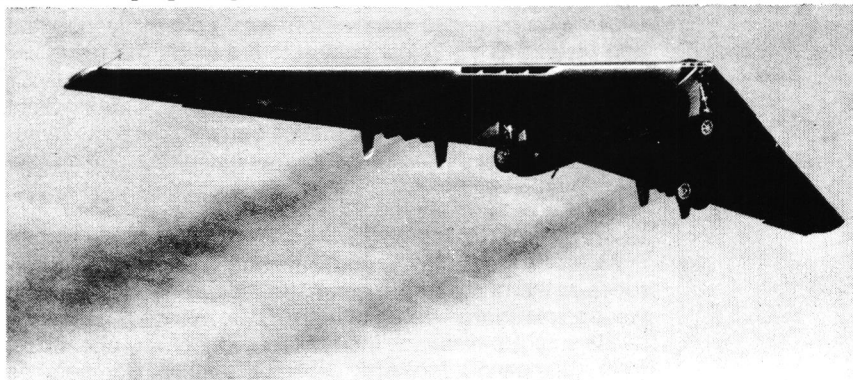
In 1945, a Northrop research team was assessing promising military technologies for the U.S. Air Force. The team was led by Northrop's Chief of Aerodynamics, William R. Sears, and his assistant, Irving L. Ashkenas. In the appendix of a secret report which they submitted to top Air Force officials, they stated that they had proven that the maximum range for an aircraft would be achieved with an all-wing configuration. At the time, Northrop was competing for a contract to build a strategic bomber for the Air Force. The Northrop proposal was the unorthodox XB-35 172 foot tailless wing design which was powered by four 3000-horsepower propeller engines. After difficulties with prop engine assemblies,

Northrop converted the flying wing to a turbojet version renamed the YB-49, which is widely accepted as the precursor to the B-2.

In early 1947, Foa headed a research group at the Cornell Aeronautical Laboratory which was conducting range analyses

[The B-2 is] 'the product of a misdirected ambition, an embarrassing error, and an unrelenting effort to conceal the facts and to obfuscate [obscure] the record.'

of the ramjet propelled Hermes missile for the General Electric Co. He found that based on aerodynamic considerations alone, the Hermes' range was considerably lower with an all-wing configuration than with a conventional wing-body configuration. After analyzing the problem further, Foa found this result to be "...quite generally true with jet propulsion." In other words with other specifications being equal, an all-wing shape would always have range inferior to a wing-fuselage shape. Foa immediately informed Sears, who had recently become chairman of Cornell's aeronautical engineering graduate school after leaving Northrop, and Dr. Clifford C. Furnas, Director of the Cornell Aeronautical Laboratory, of his discovery. He also urged that the Air Force be notified, since an error of this magnitude should not go uninvestigated.



Northrop's YB-49, a precursor of the B-2, cancelled in 1949. Courtesy of Combat Arms International.

The Product of a Coverup?

Nelson M. Kee

Sears' response surprised Foa as he noted in his memorandum, "Sears responded by stating, in effect, that what I was claiming was absurd, that he and Irving Ashkenas had rigorously proven in a Northrop report (of which he could not provide me a copy) that the optimum configuration for range in the case of the YB-49 was indeed a flying wing, and that we should definitely not proceed with the submission of the proposal I had suggested."

The Worst Possible Configuration

It took Foa three months to obtain the calculations which turned out to be in the appendix of the before-mentioned secret 1945 Northrop report. After reviewing the calculations, Foa found that the two aerody-

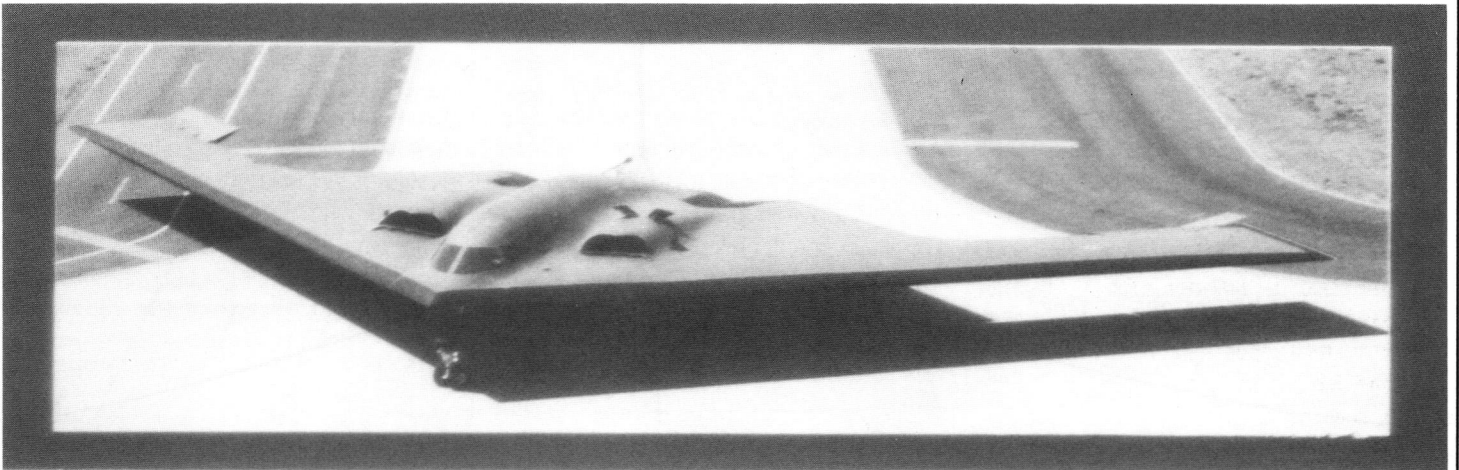
determine which extremum was the maximum and which one was the minimum. Sears and Ashkenas assumed that when $V = 1.065$, the maximum range would be achieved. However, Dr. Foa's calculations showed that a $V = 1.065$ resulted in a positive second derivative, a minimum range and a $V = 9.0$ resulted in a negative second derivative, a maximum range. Foa concluded, "... the flying wing was the aerodynamically worst possible choice of configuration for the YB-49."

The Coverup

On July 15, 1947, Foa wrote to Sears pointing out this significant error. Sears responded on July 17, 1947 writing, "As you can imagine the error is embarrassing to

concluded that under certain conditions, the best range would be achieved by an all-wing design. However, Foa's interpretation was that these conditions resulted in a wing that would be impractically thick.

Foa responded to this "coverup" by sending a critique of Ashkenas' paper to the Journal of the Aeronautical Sciences on December 13, 1948. On January 11, 1949, the Air Force canceled the YB-49 contract citing budgetary reasons. However, the Air Force later announced that "the YB-49 showed considerable promise in speed and altitude but had inadequate range." Officially, Northrop said that the YB-49 had a range of 3,155 miles carrying a 16,000 pound payload. The performance fell considera-



Northrop Corp.'s B-2 "Stealth" Bomber.

namacists had correctly related such standard parameters as weight, flying speed, thrust, fuel consumption, drag, lift, and air density. These parameters were then manipulated to find the ratio V of total (wing plus body) volume to wing volume which would result in the maximization of the range. However, the calculation of the maximum and minimum values for the total volume to wing volume ratio was reversed.

In effect, they failed to do what any good calculus student would do in the calculation of maxima and minima. The first derivatives with respect to volume were set to zero and the extrema were determined to be at $V = 1.065$ and $V = 9.0$. Their downfall was their failure to analyze the second derivative with respect to volume in order to

Irv and me - although I hardly suppose anyone has taken serious action as a result." He went on to discourage anymore studies into this error by the Laboratory for the Air Force.

Foa was completely shocked by Sears' response. However, Foa felt that the honorable thing to do was to let Sears or Ashkenas disclose the truth about their mistake. He contacted Sears and Ashkenas through Dr. Furnas at Cornell, and said he would not publicize his role in the discovery of the range error, if they would report the facts.

Ashkenas responded to this reprieve with a paper entitled "Range performance of turbojet airplanes" published in the Journal of the Aeronautical Sciences February 1948 issue. The paper was deceptive and

bly short of the projected range of 3,500 miles with 20,000 pounds of bombs.

The Memorandum

In summing up his memorandum, Dr. Foa writes, "The purpose of this memorandum [is] to call attention to the fact that the achievable performance and operational characteristics (most notably, range, cruising speed, and maneuverability) of jet-propelled flying wings are very significantly inferior to those of wing-body combinations designed to carry the same payload; and that this fact has been known for the last 40 years, particularly by those in positions of responsibility. In this light, the B-2, if it is indeed what we have now shown, could well be seen as the product of a misdirected

(continued on page 16)

Nuclear Power - The Sleeping Giant

Sameh I. Mobarek



Staff writer, Sameh I. Mobarak

The nuclear power industry, like any other industry, has experienced many changes over the preceding five decades. It has gone through a process of evolution that was necessitated by changing times and technology.

In December 1942, the first nuclear reactor, called "Critical Pile" - 1 (CP-1), went critical [maintained a chain reaction] under the direction of Enrico Fermi and his team of scientists at the University of Chicago. CP-1 was developed as an experimental reactor for producing Plutonium to support the on-going war efforts. Although CP-1's power output, less than 100 megawatt, was low relative to today's standards, it represented a scientific breakthrough. This united the fields of physics and engineering to form nuclear engineering.

It wasn't long before nuclear reactors were established as a viable source of energy for military and as civilian use. Mr. Neil Howard, Chief of Nuclear Operations at Bechtel Corporation's Gaithersburg office, recalled, "the progress of commercial and peaceful use of nuclear power was largely experimental. Different types of reactors, moderators, cooling systems and fuels were investigated only on an experimental basis." It was not until the mid

1950's that the first nuclear power plant for the commercial production of electricity was constructed by Commonwealth Edison. This reactor was designed by General Electric, and the plant was constructed by Bechtel.

The introduction of nuclear energy for commercial applications intensified efforts to develop more powerful and efficient reactors. Although there have been many different design theories, three types of reactors have become prominent: light-water reactors, heavy-water reactors, and gas-cooled reactors.

Light-water reactors use H_2O , ordinary water, as both the moderator and coolant. There are two main types of light-water reactors: pressurized-water reactors (PWRs) and boiling-water reactors (BWRs).

PWRs are the most common type of power reactors [Fig #1.] The reactor core and fuel rods are placed in a reactor vessel. Water, driven by external pumps, circulates through the reactor vessel to both moderate the nuclear reaction and cool the reactor. This water is kept pressurized at about 2200 lb/in² to prevent it from boiling, since the temperature inside the reactor vessel is in excess of 600° F. Once outside the reactor vessel, the hot water circulates into a steam generator through a system of pipes immersed in nonpressurized water which boils off as steam. This steam first drives a turbine that generates electricity, then it condenses and returns to the steam generator. In the mean time, the pressurized water, no longer hot, returns into the reactor.

BWRs operate on the same basic principles as PWRs, except that the coolant, the pressurized water in PWRs, is allowed to boil into steam directly within the reactor vessel. The steam which emerges, drives the turbine, then condenses back into water and returns to the reactor

vessel.

Heavy-water reactors use D_2O , instead of H_2O as a moderator. D, or deuterium, is an isotope of hydrogen that has the atomic weight of 2.0141, which produces a heavier water molecule as a moderator. Although heavy-water is expensive, costing \$80 million to produce 750 tons of D_2O , it allows for a much cheaper natural version of uranium to be used.

Gas-cooled reactors use graphite as a moderator and gas as a coolant. Graphite is a good moderator, and the highly enriched uranium that is used for fuel permits smaller size reactors than those that use natural uranium.

Despite the advances which occurred in the field during the 1970's, the so-called "Nuclear-Boom" faded. The dramatic increase in the cost of nuclear reactors was a direct result of two factors. First, safety requirements imposed by the National Research Council forced nuclear power plant designers to institute changes. This was coupled with prolonged periods of plant inactivity, while waiting for safety approval and certification of operation. Furthermore, the expectations of high revenues from these plants were weakening, because, as Mr. Robert Stone, Senior Vice President of Bechtel's Gaithersburg office notes, "Utilities were diverting large sums of money away from shareholders to cover these costs which naturally led to their [the sharehold-

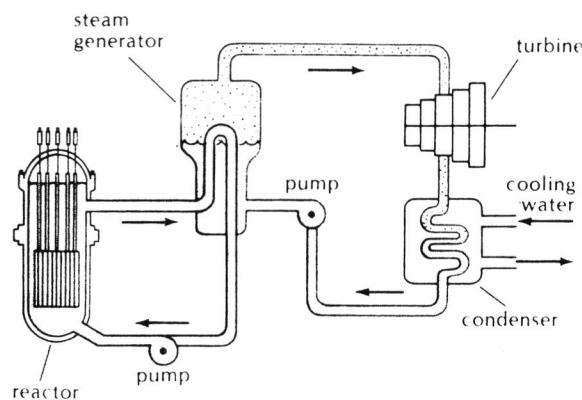


Fig #1. A schematic of a PWR nuclear reactor. Courtesy of Ohanian Physics.

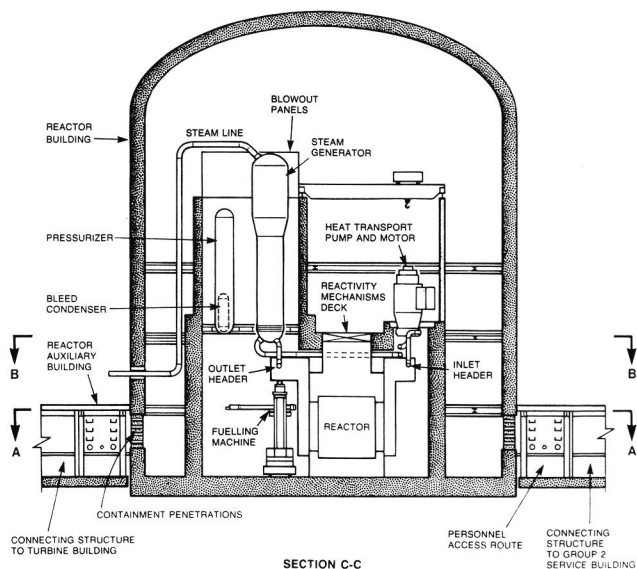


Fig #2. CANDU 300, a H-PWR Reactor. Courtesy of Bechtel Corporation

ers] opposition to nuclear power.” The increased costs also forced utilities to increase their rates, which alarmed the respective government regulatory agencies.

Then in 1979, the “Three-Mile Island” accident occurred. It was an awakening to the public to the hazards of nuclear energy. Up to this point, nuclear reactors were the concerns of corporations, not the people at large. Contrary to popular belief, this incident merely hastened the decline of an already declining industry. One piece of supporting evidence is the fact that the last reactor ordered for construction in the United States was purchased in 1978, a full year before the incident.

Since then, safety requirements have continued to increase. Advances in the field however, have begun to reduce the cost and allow for safer and more reliable designs. Moreover, the environmental and operating hazards of “fossil” power plants have become more and more conspicuous. It became apparent again, from the early 1980’s through today, that nuclear power is once again a viable source of energy.

New reactor designs stress modularity, safety, and reliability. The Canadian CANDU (Canada Deuterium Uranium) reactor, a pressurized heavy-water reactor, is a prime example of the ever increasing advancements of reactor designs. It is an infusion of the principles of PWRs in Heavy-Water reactors. The latest addition to the CANDU family is the CANDU 300 [Shown in Fig#2,] producing 450 megawatt. This

reactor complements it’s mid-size and large-size brothers, the CANDU 600 and 950. Most of the reactors in operation in the US today output 1000 to 1300 megawatt. The CANDU 300’s size makes it economical for utilities that do not need large output plants. Further, its modularity reduces the lengthy certification process and construction period. The design takes into consideration that accidents do happen, and that operators are subject to human error. Therefore, this reactor is inherently

safer than earlier models.

Recently, Westinghouse was awarded a \$50 million contract by the government to continue development of the AP600 (Advanced Passive 600) reactor [shown in Fig#3], a PWR. Aside from a reduction in parts, which adds efficiency and reduces

construction cost and time, the AP600 introduces the passive safety system. This system eliminates the need for active safety related components and procedures such as energizing diesels, pumps, and generators. It uses such natural processes as gravity, convection, and evaporation, which enhances the probability that the safety system will work when and if it is needed.

This is only a few examples of the many advancements in the field of nuclear engineering and reactor design, resulting from the demands of the current industry. The demand for new plants is expected to increase in the 1990’s with the reinstatement of confidence in nuclear energy. Mr. Stone asserts that “the need for nuclear power will increase in the future. The question is, can we find enough engineers, in all disciplines in the power field, to be able to meet this demand.”

Special thanks to Neil Howard, Edward Huges, Christopher Judd, Paul Mitchel, and Robert Stone of the Bechtel Corporation. *Editors Note: Sameh is currently employed in the Bechtel corporation, and works out of the Gaithersburg office.*

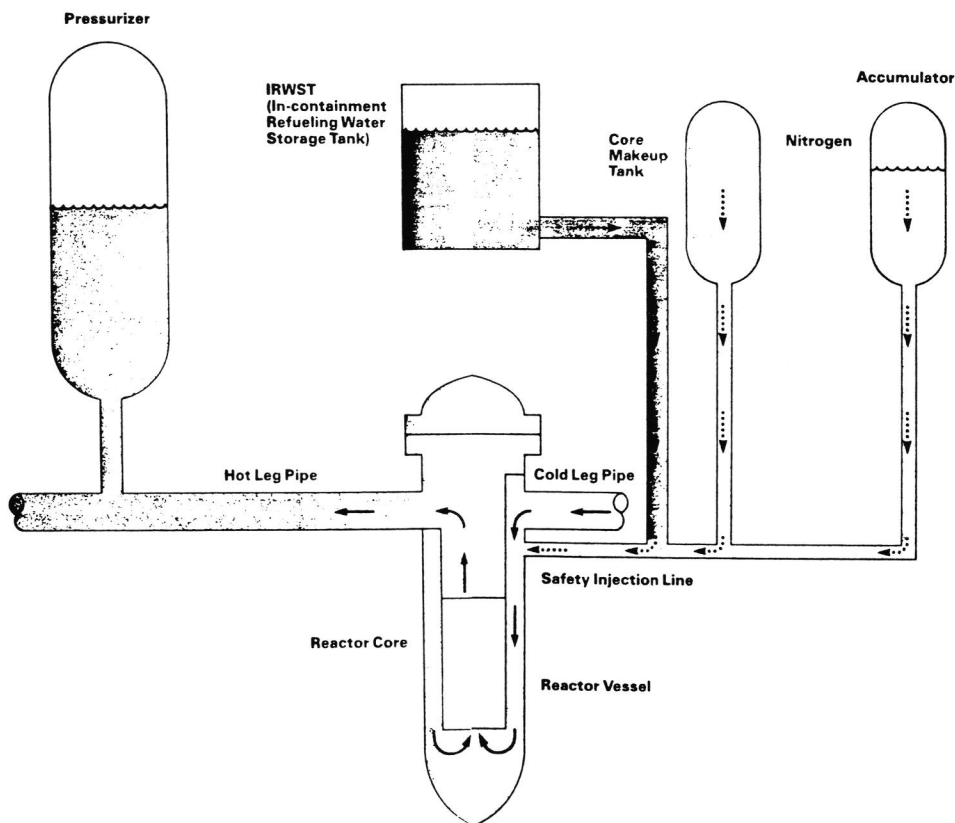


Fig #3 AP600-Advanced Passive Reactor, a Westinghouse Project. Courtesy of Bechtel Corporation.

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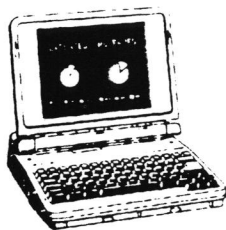


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(continued from page 13)

ambition, an embarrassing error, and an unrelenting effort to conceal the facts and to obfuscate [obscure] the record."

Uncovering the Coverup?

A recent article published in The Washington Post, "B-2 'Stealth' Bomber Has Shorter Cruising Range Than Older, Cheaper B-1," seems to support Dr. Foa's allegations. The article reveals that the estimated unrefueled ranges of the B-2 and the B-1 are 6,000 and 6,400 miles respectively. Many leading lawmakers were shocked by this, including the House Armed Services Committee Chairman Les Aspin (D-Wis.) who said, "I'm surprised at that... They've been advertising the B-2 as having better

range."

Professor Foa describes the resurrection of the flying wing concept by Northrop as a "second coverup." Much of the range controversy may be resolved after flight tests have been completed for the B-2. Until then, the B-2's range adds yet another variable to an already complex equation which will determine the Stealth bomber's future. This equation is already complicated by such factors as budgetary limitations, a questionable mission, and increased Glasnost. However, one thing is certain. This radar eluding "Stealth" bomber has a very visible pricetag for a budget minded Congress. ■

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